SCIENCE DEPARTMENT

OVERVIEW OF REQUIREMENTS
Students are required to take three science credits for graduation as well as either pass the Biology HSA or take the MISA exam. Students are encouraged to take additional science courses as electives in order to achieve a well-rounded science education.

SPECIFIC REQUIREMENTS

For incoming 9th graders and rising 10th graders
- In order to graduate with a diploma, students must take a year each of NGSS biology, NGSS chemistry and NGSS physics. Additionally, students pass the MISA exam (which will be given in the junior year). Alternatively, students can satisfy the MISA requirement by earning a score of 3 or higher on any AP science exam.

For rising 11th and 12th graders:
- Three science courses one of which must be biology, another a physical science and lastly a science elective**. The biology requirement is satisfied with Biology, Honors Biology, or APEX Biology. The physical science requirement is satisfied with any of the following:
  - Any Chemistry class
  - Any Physics class
  - Astronomy
- ** - The elective course can be satisfied with any of the courses listed under ELECTIVE COURSES. Additionally, they must either have passed the Biology HSA or sat for the MISA exam.

Science and Math coursework
- There is a strong correlation between student achievement in science classes and their success in math classes. Therefore, three typical starting sequences for students entering the 9th grade are described below:

9th grade course sequence recommendation (based on math course work)

For Algebra 1 students:
- Freshman year: Biology
- Sophomore year: Chemistry or Honors Chemistry
- Junior year: Physics or Honors Physics

For Geometry or Honors Geometry students:
- Freshman year: Biology or Honors Biology
- Sophomore year: Chemistry, Honors Chemistry.
- Junior year: Physics, Honors Physics, AP Physics I, or AP Chemistry

For Algebra II students:
- Freshman year: Honors Biology and Honors Chemistry**
- Sophomore year: AP Chemistry or AP Physics I

**Note: This option is a very challenging start to high school, and is recommended only for students with very strong math skills and exceptional interest in the sciences
ELECTIVE COURSES
Elective courses are offered at grade level, honors or Advanced Placement (college) level. Honors credit in the weighted GPA is granted for grades of A or B only, in honors and AP courses.

- Grade level:
  - Astronomy
  - Environmental Science
  - Horticulture
  - Chemistry (considered an elective for rising 11th and 12th graders only)
  - Physics (considered an elective for rising 11th and 12th graders only)

- Honors Courses:
  - Anatomy and Physiology
  - Engineering Science
  - Executive High School Internship (available for rising 12th graders only)
  - Forensic Science
  - Molecular Biology
  - Honors Chemistry (considered an elective for rising 11th and 12th graders only)
  - Honors Physics (considered an elective for rising 11th and 12th graders only)

- Advanced Placement Courses (AP®)
  These courses are rigorous college-level courses. Successful completion of the corresponding AP® test is required for credit upon college admission. These courses are NGSS aligned.
    - AP® Biology (double-period class; 2 credits)
    - AP® Chemistry (double-period class; 2 credits)
    - AP® Environmental Science
    - AP® Physics 1
    - AP Physics C

DESCRIPTION OF SCIENCE COURSE OFFERINGS

BIOLOGY A/B 363100/363200
BIOLOGY A/B, APEX 36213300/36223300
BIOLOGY A/B, HONORS 362100/362200

Grades: 9, 10, 11, 12

This NGSS aligned course emphasizes the patterns, process, and relationships of living organisms. Students will use observations, experiments, hypotheses, tests, models, theory and technology to explore how life works. Core ideas include structures and processes in organisms, ecology, heredity, and evolution. There will be multiple opportunities for student to apply these ideas in developing solutions to authentic problem-based scenarios while also exploring career opportunities.
**DESCRIPTION OF SCIENCE COURSE OFFERINGS (cont.)**

**CHEMISTRY A/B**  
372100/372200  
**CHEMISTRY A/B, HONORS**  
371100/371200  
**Grades:** 9, 10, 11, 12

This NGSS aligned course emphasizes the study of matter through inquiry. Through the use of laboratory investigations, students will explore their world at the atomic level. Using data, evidence, and scientific modelling, students achieve a deeper understanding of changes in matter. Topics of study will include structures and properties of matter, weather and climate, chemical reactions, conservation of mass/energy, and relationships between Earth and human activity.

**Pre-requisite:** Successful completion of Algebra 1  
**Co-requisite:** Minimum of Geometry  
**Recommended Minimum Co-requisite for Honors Chemistry:** Honors Algebra II

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**PHYSICS A/B**  
383100/383200  
**PHYSICS A/B, HONORS**  
382100/382200  
**Grades:** 10, 11, 12

This NGSS aligned course investigates physical laws and theories, relationships of physical phenomena, and the interrelationships of physics to other fields of human endeavor. Topics include traditional physics subjects (Newtonian mechanics: dynamics, momentum, energy; electricity and magnetism; waves) along with related subjects in earth science (plate tectonics; earthquake activity) and astronomy (solar evolution).

**Prerequisite:** Successful completion of Geometry

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**ASTRONOMY A/B**  
385600/385700  
**Grades:** 11, 12

This elective science course focuses on our Solar System and planetary astronomy. Astronomy A includes: The Earth, the Moon, the Sun, the other planets, and additional bodies such as moons, asteroids, and comets. Astronomy B includes: cosmology, stars, nebulae, pulsars, black holes, galaxies, quasars, and the Big Bang theory. Evening observing sessions with telescopes, and visits to an observatory and/or planetarium may be included. Either semester may precede the other or semesters may be taken independently.
ENVIRONMENTAL SCIENCE A/B 366100/366200
Grades: 10, 11, 12

Environmental Science A and B explore the ever-changing relationship between living things and their environment. The effects of human activity on the environment are given special attention. Environmental Science A explores the nature of ecosystems, such as the environmental history of the Great Lakes, energy flow from plants to animals and other living things, cycles of nutrients, world population, organization of biological communities, and the effects of pollution. In Environmental Science B, students study such topics as urban and non-urban land use, water use, nonrenewable resources, energy resources, food resources and the effects of an increasing human population.

HORTICULTURAL SCIENCE A/B 367100/367200
Grades: 11, 12

Horticulture Science teaches students techniques for the care and culture of plant life in the home, business, and community. Attention is given to plant propagation, identification, genetics, behavior, and requirements. Laboratory work is adjusted to utilize the indoor greenhouse as well as maintenance of school flowerbeds. Horticultural Science A includes careers in horticulture, plant structure and behavior, conditions affecting plant growth, plant propagation, control of disease, weeds and pests, and greenhouse management. Horticultural Science B includes plant identification, soils and their preparation, crop plants, management of lawns, and landscaping.

ADVANCED (HONORS) LEVEL COURSES

ANATOMY AND PHYSIOLOGY, HONORS, A/B 376100/376200
Grades: 11, 12

This advanced level course is intended for students who have succeeded in biology and wish to study how the human body works in greater detail. Anatomy and Physiology is an honors level course that focuses on two main ideas. One, form relates to function (for example, how the structure of the human hand enables it to perform many tasks) and two, chemistry helps explain how living things work. Semester A begins with an introduction to anatomical terms, then a review of cells and their organelles. This is followed by a unit on histology (tissues) and how their structure relates to their function.

The body systems taught in semester A include the integument system, skeletal system and joints, and nervous system. Semester B completes the study of human body systems. Topics include the muscular, digestive, circulatory, respiratory, and reproductive systems. Dissection is a course requirement.

Prerequisite: Successful completion of Biology and either completion of or concurrent enrollment in Chemistry
ADVANCED (HONORS) LEVEL COURSES (cont.)

MOLECULAR BIOLOGY, HONORS, A/B  
Grades: 11, 12  
365700/365800

This honors course is intended for advanced students who have succeeded in biology and wish to study advanced concepts and theories of molecular genetics in greater detail. A molecular understanding of gene expression and recombinant DNA technology is emphasized, and resulting issues from the Human Genome Project, gene therapy, and bioethics are also discussed. This course provides practical training for biological research. In semester A, students learn the concepts and techniques that will be used during the second semester, when students will conduct original research in conjunction with Rutgers University.

**Prerequisite:** Successful completion of Biology and either completion of or concurrent enrollment in Chemistry

**Recommended:** Successful completion of Chemistry

ENGINEERING SCIENCE, HONORS, A/B  
Grades: 11, 12  
360900/361000

Engineering science is a single period, project-based STEM course that uses concepts from physics to design a multifunctional product. Through the design and engineering of a mid-sized sailboat, this course exposes students to the challenges and rewards of the engineering process while introducing major concepts such as needs assessment, design spiral, drafting, 3-D scale modeling, CAD, and performance testing.

EXECUTIVE HIGH SCHOOL INTERNSHIP

**Grade 12 only**

See www.walterjohnson.com/programs/internships for information.

FORENSIC SCIENCE, HONORS, A/B  
Grades: 11, 12  
386400/386500

This course focuses on forensic science and modern crime scene investigation techniques. Forensic Science A includes the topics of forensic science history, crime scene investigation and evidence collection, forensic entomology, serology, pathology, anthropology and odontology. Forensic Science B explores the topics of trace evidence, DNA analysis, toxicology, fingerprint collection and analysis, firearms, ballistics, and explosives. Either semester may precede the other or semesters may be taken independently.

**Pre/Co-requisite:** Successful completion of Biology and either completion of or concurrent enrollment in Chemistry
**AP® COURSES**

**AP® BIOLOGY A/B**
Grades: 11, 12

Topics in AP® Biology are selected from the Advanced Placement® curriculum. This is a college level course and students may elect to take the Advanced Placement® examination in order to qualify for college credit or advanced standing. AP® Biology emphasizes laboratory work in all areas of the curriculum. This is a double-period class. AP® Biology A includes biochemistry, the behavior of cells, cellular energetics, heredity, molecular genetics, and evolutionary biology. AP® Biology B includes the diversity of organisms, structure, and function of plants and animals, behavior of organisms, and ecology. Students will be prepared to take the AP® Biology exam in May. This course is NGSS aligned.

**Prerequisite:** Successful completion of Biology and Chemistry; AP® Biology A is a prerequisite for AP® Biology B

**AP® CHEMISTRY A/B**
Grades: 10, 11, 12

AP® Chemistry is for students with a strong interest in chemistry and related fields, such as engineering. Topics are selected from the Advanced Placement® curriculum and are taught at a college level. Students may elect to take the Advanced Placement® examination in order to qualify for college credit or advanced standing. AP® Chemistry emphasizes laboratory methods and analyzing data using statistics and logical reasoning. This is a double-period class. AP® Chemistry A covers topics in atomic theory, stoichiometry, gas laws, thermodynamics, reaction rates, acids/bases, and solutions. Students in AP® Chemistry B explore types of chemical reactions, chemical equations, reaction rates, equilibrium systems, and principles of chemical reactions. Students will be prepared to take the AP® Chemistry exam in May. This course is NGSS aligned.

**Prerequisite:** Successful completion of Biology, Chemistry, and Algebra II. A strong ability to apply mathematical concepts from previous math classes is essential to success. AP® Chemistry A is a prerequisite for AP® Chemistry B.

**Recommended:** Concurrent enrollment in Honors Pre-Calculus
**AP® ENVIRONMENTAL SCIENCE A/B**

Grades: 10, 11, 12

This course is based on the course outline designed by the College Board. It provides students with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving and/or preventing them. Laboratory and field investigation complement the classroom portion of the program, providing opportunities to test concepts and principles that are introduced in the classroom. Fieldwork, along with an investigation and research of greenhouse ecosystems, allows students to explore specific problems in ways that are challenging, realistic, and relevant to their lives. Students will be prepared to take the AP® Environmental Science exam in May. This course is NGSS aligned.

**Pre-requisite:** Successful completion of Biology. AP® Environmental Science A is a prerequisite for AP® Environmental Science B.

**Pre/Co-requisite:** Completion of or concurrent enrollment in Chemistry A/B.

**AP® PHYSICS I A/B**

Grades: 10, 11, 12

This course is an algebra-based physics course that is the equivalent of a first-semester college physics course. Students will learn Newtonian mechanics which includes rotational dynamics and angular momentum, work, energy, power and mechanical waves and sound, and electrical circuits. This course provides an excellent foundation for students who intend to major in the sciences. This course prepares students for the AP® Physics I test in May. This course is NGSS aligned.

**Pre-requisite:** Geometry

**Co-requisite:** Algebra II

**Recommended:** Concurrent enrollment in Pre-calculus

**AP® PHYSICS C A/B**

Grades: 11, 12

This course is for highly motivated students with interest in majoring in the physical sciences or engineering. Students use calculus in problem solving and derivations as they study Newtonian mechanics, electricity, and magnetism. Students will be prepared to take both of the Advanced Placement® Physics C examinations (Mechanics as well as Electricity & Magnetism) at the end of this course.

**Prerequisite:** Successful completion of Physics A/B, Hon Physics A/B or AP® Physics 1 & Pre-calculus A/B.

**Pre/Co-requisite:** Concurrent enrollment in or completion of Calculus
Average Weekly Study Hours
*(please use this information to help you plan your schedule)*

<table>
<thead>
<tr>
<th>NGSS course work</th>
<th>Weekly Study Hours</th>
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<tbody>
<tr>
<td>Biology A/B</td>
<td>4 hours</td>
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<tr>
<td>APEX Biology A/B</td>
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<tr>
<td>Honors Biology A/B</td>
<td>5 hours</td>
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<tr>
<td>Chemistry A/B</td>
<td>3 hours</td>
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<tr>
<td>Honors Chemistry A/B</td>
<td>4 - 5 hours</td>
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<tr>
<td>Physics A/B</td>
<td>2.5 hours</td>
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<tr>
<td>Honors Physics A/B</td>
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<table>
<thead>
<tr>
<th>Electives</th>
<th>Weekly Study Hours</th>
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</thead>
<tbody>
<tr>
<td>Environmental Science A/B</td>
<td>1 hour</td>
</tr>
<tr>
<td>Horticultural Science A/B</td>
<td>1 hour</td>
</tr>
<tr>
<td>Anatomy &amp; Physiology A/B</td>
<td>3 - 5 hours</td>
</tr>
<tr>
<td>Molecular Biology A/B</td>
<td>3 - 4 hours</td>
</tr>
<tr>
<td>Engineering Science A/B</td>
<td>3 hours</td>
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<tr>
<td>Executive High School Internship</td>
<td>1 hour</td>
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<tr>
<td>Forensic Science A/B</td>
<td>3 - 4 hours</td>
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<table>
<thead>
<tr>
<th>AP Course offerings</th>
<th>Weekly Study Hours</th>
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<tbody>
<tr>
<td>AP Chemistry A/B</td>
<td>6 - 8 hours</td>
</tr>
<tr>
<td>AP Environmental Science</td>
<td>6 - 8 hours</td>
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<tr>
<td>AP Physics I A/B</td>
<td>6 - 8 hours</td>
</tr>
<tr>
<td>AP Physics C A/B</td>
<td>6 - 8 hours</td>
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